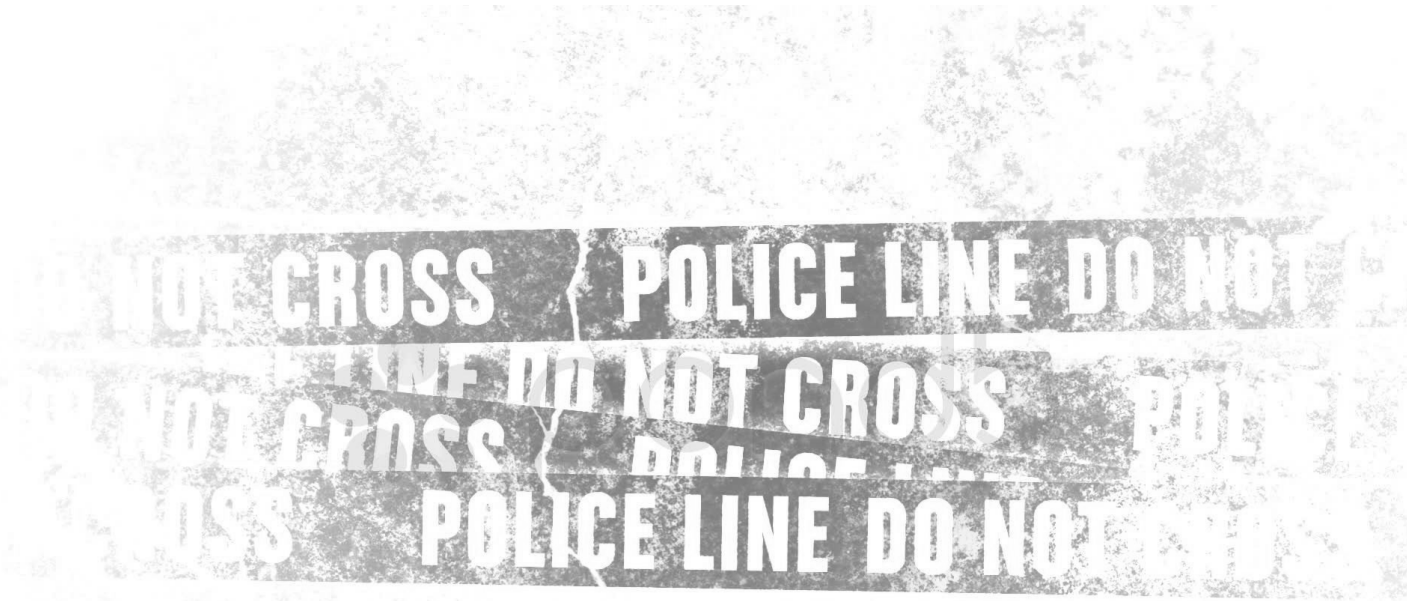

Sudden and Unexpected Death From Natural Causes

Chapter 6

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Correction file

Chapter 6

Sudden and Unexpected Death From Natural Causes

Introduction

- In countries where deaths have to be officially certified, the responsibility for certification falls either to the doctor who attended the patient during life or one who can reasonably be assumed to have sufficient knowledge of the clinical history to give a reasonable assessment of the cause of death. This is an 'honest opinion, fairly given'.
- Many studies have shown that there is a large error rate in death certificates and significant differences between the clinician's presumption of the cause of death and the lesions or diseases actually displayed at the autopsy.
- Changes to the legislation applicable to death certification are expected in the UK and it is expected that all death certificates will be scrutinized by a medical practitioner (a Medical Examiner):
  - Who will be in a position to advise doctors on the wording of the cause of death given on the certificate.
  - Advise the Coroner of medical matters pertaining to death certification and identify trends in deaths in their area.
- There is a different approach to sudden and unexpected deaths, These deaths are usually reportable to the authorities for medico-legal investigation.
- In England and Wales, doctors should only issue a death certificate if they are satisfied that they know the cause of death and that it is from natural causes.
- Before completing the death certificate, the body must be examined after death, unless the patient had been examined by that doctor in life within the previous 14 days.

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Definition of sudden death

- WHO definition of a sudden death is death within 24 hours of the onset of symptoms.
- In forensic practice most sudden deaths occur within minutes or even seconds of the onset of symptoms.
- Indeed, it is very likely that a death that is delayed by hours will not be referred to the Coroner or other medico-legal authority, as a diagnosis may well have been made, and a death certificate can be completed by the attending doctors.
- It is crucial to remember that a sudden death is not necessarily unexpected and an unexpected death is not necessarily sudden, but these two facets are often combined.

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Cardiovascular System

Disease of Heart

When a natural death is very rapid, the most common cause of irreversible cardiac arrest is a cardiovascular abnormality. the following lesions are the most significant as causes of sudden unexpected death.

A. Coronary artery disease:

- Narrowing of the lumen by atheroma àischemia of myocardium supplied by ità may led to electrical instability (arrhythmia).
- If HR increased → the oxygen demand increase → cannot be met due to restriction of blood → myocardium distal to the stenosis will become ischemic.
- Ischemia **does not** invariably lead to myocardial infarction, it just has to be sufficiently severe to initiate a fatal arrhythmia, **unless** it was in pace-making nodes or a major branch of the conducting system the risk will increase.

Complications of atheromatous plaques which can worsen the stenosis:

1. Bleeding may occur into a plaque > seen as sub-intimal hemorrhage at autopsy.
2. Sudden expansion of the plaqueà may lead to rupture
3. When it ruptures the lipid content will go to the coronary.
4. It is the sight for the development of thrombi
5. Coronary thrombosis underlies most of the complications of coronary artery atherosclerosis, including unstable angina, acute myocardial infarction and sudden cardiac death.
6. The fatal effects of an infarct may appear at any time after the muscle has become ischemic.
7. The area of the myocardial infarct is weakest between 3 days and 1 week after the clinical onset of the infarct and it is at this time that the weakened area of myocardium may rupture, leading to sudden death from a hemopericardium and cardiac tamponade.
8. Cardiac aneurysms may form at sites of infarction; they may calcify and they may rupture.

Chapter 6

Disease of The Heart

B. Hypertensive heart disease

- Long standing HTN → myocardial remodeling, **(LV hypertrophy)**
- Normal heart weight 400 g for the average man, although dependent on body size/weight.
- Enlarged heart + trigger → chronic myocardial hypoxia and electrical instability → fatal arrhythmia.
- Hypertensive heart disease frequently coexists with coronary artery atherosclerosis, increasing the potential for the development of fatal arrhythmias at times of cardiovascular 'stress'.

C. Aortic stenosis

- A disease that classically affects older individuals with calcified tricuspid aortic valves (may also be seen in younger people who have a congenital bicuspid aortic valve)
- The accompanying myocardial hypertrophy is similar to that caused by hypertension (which may, in some cases, produce heart weights of over 700g).
- In AS myocardial perfusion is worsened by the narrow valve, which results in a lower pressure at the coronary ostia and hence in the coronary arteries. Sudden death is common in these patients.

D. Senile myocardial degeneration

- **Senescence** is a well-accepted concept in all animals, and few humans survive beyond 90–100 years.
- The cause of a sudden death in these elderly individuals can be very difficult to determine.
- The senile heart is small, the surface vessels are tortuous and the myocardium is soft and brown owing to accumulated lipofuscin in the cells.

Disease of The Heart

E. Primary myocardial disease:

- Less commonly , affect **younger group**, and they include conditions where there is a structural abnormality of the heart that is visible to the 'naked eye' and/or under the microscope.
- **Myocarditis** occurs in many infective diseases like diphtheria and viral infection, including influenza, and sudden death may happen days or weeks after the mine clinical symptoms in some.
- Myocarditis may be suspected macroscopically because of the presence of pale or haemorrhagic foci in the myocardium (having a 'mottled' appearance).

The cardiomyopathies:

Important group of conditions linked to sudden death in the **young**, and are of particular importance in deaths occurring during exercise, or on the athletic field.

The group of disorders including:

- Hypertrophic cardiomyopathy (HCM): symmetrical/asymmetrical hypertrophy, a sub-aortic mitral 'impact lesion' and myocyte disarray.
- Dilated cardiomyopathy (DCM): may be a 1ry or 2ry (to chronic alcohol misuse).
- Arrhythmogenic right ventricular cardiomyopathy (**ARVC**): right ventricular thinning with fibro-fatty myocyte replacement.

Channelopathies:

- Small proportion of cardiac sudden deaths with normal investigations (with a structurally normal heart).
- Often 'triggered' by a stimulus (exercise, sudden loud noise or even during sleep). Such deaths fall under **sudden adult death syndrome (SADS).**
- New entities are continually being discovered in this group. the main syndromes currently recognized include Wolff–Parkinson–White, Long QT, Short QT, Brugada and Catecholaminergic Polymorphic Ventricular Tachycardia and Idiopathic Ventricular Fibrillation.
- Pathologically there is no macro or micro abnormalities in the heart as the defects are at a molecular level**.**

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Cardiovascular System

Disease of The Arteries

The most common lesion of (extracardiac) arteries associated with sudden death is the aneurysm.

A. Atheromatous aneurysm of the aorta:

- Most commonly found in elderly in the abdominal aorta.
- Formed when the elastic component of the aortic wall underlying an atheromatous plaque is damaged and blood under pressure is able to 'balloon' the weakened wall.
- Saccular (expanding to one side) or fusiform (cylindrical).
- Many aneurysms remain intact and are found as an incidental finding at autopsy, but others eventually rupture.
- Bleeding is into retroperitoneal space.

B. Dissecting aneurysm of the aorta:

- damage caused by an atheromatous plaque à intimal defect and weakening of the media à blood from the lumen to 'dissect' into this weakened arterial wall ،resulting in hemorrhage into the thorax or abdomen.
- The commonest site is in the thoracic aorta with dissection tracking distally.
- Found in individuals with hypertension. May also be seen in younger individuals
- with connective tissue defects, such as Marfan syndrome

C. Syphilitic aneurysms:

- Rarely Seen in autopsies of elderly, The aneurysms are thin walled. Found in arch of thoracic aorta and their Rupture causes torrential hemorrhage.

Cardiovascular System

Intracranial vascular lesions:

A. Ruptured berry aneurysm:

- Common cause of sudden collapse/rapid death of young - middle aged men/women is subarachnoid haemorrhage from ruptured berry aneurysm of the basal cerebral arteries.
- It can be described as 'congenital' weakness in the media of the vessel wall (usually at a bifurcation) → Clinically silent or causing severe headache, neck stiffness, unconsciousness/other neurological symptoms
- Mechanism of sudden death is not understood however bathing the brainstem in blood may invoke vascular spasm resulting in critical ischemia of cardiorespiratory control centers. subarachnoid blood under pressure may directly affect such brainstem cardiorespiratory control.
- The controversial Causes of the rupture can be ether do to:
  - Any physical evidence of blunt force head injury.
  - Transient elevation of blood pressure.
- **Classic scenario**: intoxicated individual receives blow to head. Collapses and suffers cardiac arrest.

B. Cerebral hemorrhage, thrombosis and infarction:

- Sudden bleeding into brain tissue is common in old age and people with significant hypertension.
- Together with cerebral thrombosis and resulting brain infarction is the commonest cause of the well-recognized cluster of neurological signs colloquially termed a 'stroke'.
- The term cerebrovascular accident (CVA) is **used as diagnostic and as cause of death, But** do to misinterpreted of the name because of the word "accident" . It's more satisfactory if we use the exact cause (cerebral haemorrhage or cerebral infarction) or, if the etiology is not known, to use the generic term cerebrovascular lesion .
- Sudden expansion of hematoma compresses internal capsule → Hemiplegia.
- Death in such circumstances is not usually sudden, although there is a complex interaction between the brain and the heart, and thus a 'stroke' affecting a region of the brain important in such control can precipitate a cardiac arrest.

Respiratory System

Major cause of sudden in respiratory organs death is vascular.

- Most commonly and often underdiagnosed is pulmonary embolism. Most are silent , **but** a proportion embolize and block pulmonary arteries of varying size. Large thromboemboli can occlude the origin of the pulmonary arteries (saddle emboli),will lead to **mechanical blockage** → Resulting in acute right heart strain and failure. Smaller lodged in smaller calibre pulmonary blood vessels where they interfere with pulmonary function and lead to myocardial ischaemia and cardiac arrest.
- Other rare causes of death in respiratory: massive haemoptysis from pulmonary tuberculosis or from an invasive tumor. Repped but not sudden deaths can be also do to fulminating chest infections, especially virulent forms of influenza.

Gastrointestinal System

Major cause of sudden death is vascular.

- Severe bleeding from ulcer.
- Mesenteric thrombosis/embolism related to aortic or generalized atherosclerosis → infarction of the GUT → rapped but not sudden death if not diagnosed.
- Strangulated hernia, obstruction or torsion → intestinal infarction.
- Peritonitis.
- Many of these conditions present as sudden death in elderly people because they cannot, or will not, seek medical assistance at the onset of the symptoms.

Gynecological Conditions

When a female of childbearing age is found dead, a **complication of pregnancy** must considered to be the most likely the cause of death until other cause been excluded (e.g. Illegal abortions ruptured ectopic pregnancy ...).

Maternal deaths (during pregnancy or within 12 months of parturition) are:

- **Direct** deaths by diseases specifically related to pregnancy: pulmonary thromboembolism, preeclampsia, obstetric hemorrhage, amniotic fluid embolism, acute fatty liver of pregnancy or ectopic gestation.
- **Indirect** deaths from pre-existing disease exacerbated by pregnancy: congenital heart disease or a cardiomyopathy.
- Maternal deaths are the subject of anonymous review

Asthma and Epilepsy

Asthma:

- **Infrequent** cause of death.
- Some of the triggers of asthma are heroin and crack cocaine particularly if it's smoked.
- By naked eye autopsy finding: hyper-inflated lungs and mucus plugging the airway by tenacious, viscous mucus.
- An anaphylactic component may be responsible for a fatal outcome, and post-mortem blood sampling for mast cell tryptase is often rewarding.

Epilepsy:

- It is associated with an increased risk of mortality.
- May be :
  - ✓ **Specific** (drowning from seizure while swimming)
  - ✓ **Unspecific** (sudden unexpected death in epilepsy SUDEP), where the precise cause of death is not identified also **defined as sudden unexpected, witnessed or unwitnessed, non-traumatic and non-drowning death in epilepsy** with or without evidence of a seizure, and excluding documented status epilepticus, where post-mortem examination does not reveal a toxicological or anatomic cause of death'.
  - ✓ **Seizure-induced** arrhythmia, seizure-mediated inhibition of respiratory centres or a complication of anti-epileptic treatment.
  - ✓ **Post-mortem findings in SUDEP are non- specific.**
  - ✓ Neuropathological examination of the brain is important in order to exclude the presence of a lesion capable of providing an explanation for seizure activity.
  - ✓ Presence of stable changes in brain represent evidence of seizure activity, cannot be taken as evidence of seizure at time of death.

Thank You